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EXAMINER

WEST, JEFFREY R

ART UNIT

PAPER NUMBER

2857

DATE MAILED: 10/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/810,932

Applicant(s)

JONES ET AL.

Examiner

Jeffrey R. West

Art Unit

2857

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 June 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-70 is/are pending in the application.
- 4a) Of the above claim(s) 14-20, 31-39 and 55-59 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-13, 21-30, 40-54, and 60-70 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 March 2001 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 4-6.
- 4) ☒ Interview Summary (PTO-413) Paper No(s). 7.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:

- I. Claims 1-13, 21-30, 40-54, and 60-70, drawn to method and system for testing a transmission line using time domain reflectometry, classified in class 702, subclass 108.
- II. Claims 14-20 and 55-59, drawn to processing a reflection signal for dimensional determination, classified in class 702, subclass 159.
- III. Claims 31-39, drawn to method of signal generation, classified in class 702, subclass 124.

2. The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are unrelated. Inventions are unrelated if it can be shown that they are not disclosed as capable of use together and they have different modes of operation, different functions, or different effects (MPEP § 806.04, MPEP § 808.01). In the instant case group I performs time domain reflectometry to determine the location of a line anomaly by correlating a reflection signal with a generated signal. Group II locates the location of a line anomaly using a dissimilar method of processing the reflection signal using a prediction module with coefficient modification. These different modes of operation cannot be used together because the received reflection signal is manipulated in two unrelated ways depending on the method used.

Inventions I and III are related as combination and subcombination. In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the subcombination contains specific sequence identifying features not necessary in carrying out the method of invention I. The subcombination has separate utility such as generating any sequence signal used in transmission, for example, a spread-spectrum communication device.

Similarly, inventions II and III are related as combination and subcombination. In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the subcombination contains specific sequence identifying features not necessary in carrying out the method of invention II. The subcombination has separate utility such as generating any sequence signal used in transmission, for example, a spread-spectrum communication device.

Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

3. During a telephone conversation with Mr. Chad W. Miller on September 30, 2002, a provisional election was made without traverse to prosecute the invention of Group I, claims 1-13, 21-30, 40-54, and 60-70. Affirmation of this election must be made by applicant in replying to this Office action. Claims 14-20, 31-39, and 55-59 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected invention.

4. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Drawings

5. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: "514B", "520A", "520B", "520C", "524", and "650". A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

6. The abstract of the disclosure is objected to because its length exceeds the 150 word limit. Correction is required. See MPEP § 608.01(b).

7. The disclosure is objected to because of the following informalities:

Art Unit: 2857

On page 13, lines 16-18, it is unclear why the "communication interface" is mentioned twice.

On page 14, line 5, "module 200 connect to a hybrid 204" should be --- module 200 connects to a hybrid 204---.

On page 23, lines 14 and 20, the "line interface" is incorrectly labeled "412" instead of "408" as it is labeled on page 23, line 12 and in Figure 4.

On page 23, line 14, "includes apparatus" should be --- includes an apparatus---.

The description on page 25, lines 17-19 is confusing because the multipliers are referenced by both reference characters and setting values. It is suggested that "connecting to a delay register 510C and to a multiplier C_{N-1} . The output of delay register 510C connects to a multiplier 514C that has a multiplier C_N " be changed to match the language of the description on page 25, line 16, as --- connecting to a delay register 510C and to a multiplier 514B, set to C_{N-1} . The output of delay register 510C connects to a multiplier 514C, set to C_N ---.

On page 30, line 20 to page 31, line 1, and page 44, line 10, the title of the texts should be underlined.

On page 44, line 8, the "prediction filter" is incorrectly labeled "1012" instead of "1004" as it is labeled on page 43, line 10 and in Figure 10.

On page 46, line 12, the "correlation step" is incorrectly labeled "1220" instead of "1222" as it is labeled on page 46, line 6 and in Figure 12.

Art Unit: 2857

On page 48, line 1, "Once the desired sequence is specified at step 1410, the system" should be ---Once the desired sequence is specified, at step 1410 the system---.

On page 53, line 18, the step "subtracts T_2 from T_1 " is not in accordance with Figure 18, which gives the formula $T_2 - T_1$ (i.e. subtracts T_1 from T_2).

Appropriate correction is required.

Claim Objections

8. Claims 21 and 33 are objected to because of the following informalities:

In claim 21, "transmitted to generated the reflection" should be ---transmitted to generate the reflection---.

Claim 33 is objected to because of incorrect dependency. Claim 33 recites, "wherein the sequence identifier further comprises information about the sequence repetition number". This limitation is not supported by parent claim 30, but is supported by parent claim 31 which recites, "providing a sequence identifier to a sequence generator". Therefore, it is assumed that claim 33 depends from claim 31.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and

Art Unit: 2857

the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 1-5, 26, 27, 45, 46, 48, 49, 60, 62, and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,298,118 to Liggett in view of U.S. Patent No. 5,600,248 to Westrom et al.

Liggett teaches a method for testing a twisted pair communication channel using time domain reflectometry (column 4, lines 11-16) comprising a pseudo-random code processor that generates and decodes pseudo-random coded signals to be transmitted on, and received from, the twisted pair conductor channel (column 4, lines 64-67), such as an asymmetric digital subscriber line (column 3, lines 48-49) connected to a computer modem for communication on the channel (column 3, lines 33-34), wherein the signals are sent at a low energy (i.e. power) level to lower the possibility of cross-talk occurring across the various twisted line channels (column 5, lines 9-12). Liggett also teaches that the transmitted signals (i.e. test signals) are generated using a code generator that reads from a shift register memory to define a specified maximal length sequence code, with corresponding taps, (column 5, lines 13-18 and 25-30) which is transmitted over the communication channel and reflected back, in response to the transmission, to the receiver for sending to a cross-correlator (column 5, lines 18-24) which correlates the original maximal length sequence signal with the reflected signal (column 5, lines 51-55). Liggett also teaches that a peak detector detects a plurality of peaks (i.e. signal components) of the reflected signal including peaks in response to an unwanted near-end echo

pulse at the start of the signal, caused by reflection at the line interface, and a bridged tap in the communication channel (column 7, lines 30-37).

Liggett, however, does not teach a method for removing the unwanted near-end echo or a method for measuring the location of the fault in the communication line.

Westrom teaches a fault distance locator for underground cable circuits comprising generating a pulse into a communication channel to obtain a reference pulse signal (i.e. template), during a setup operation, (column 4, lines 62-65) and, during actual operation, receiving a plurality of reflected pulses (column 8, lines 41-51) including an unwanted near-end echo pulse, caused by the reflection at the line interface, which is removed by subtracting the obtained reference/template pulse data from the actual received pulse data set (column 9, lines 9-21). Westrom then teaches determining a time interval between the beginning of the pulse injection and the subsequent peak/pulse (i.e. point of correlation) indicative of a line abnormality and then multiplying the time interval times the propagation speed to determine the distance to the location of the fault (column 9, lines 56-64). Westrom also teaches a computer controller comprising a microprocessor and a corresponding memory for storing a program, executed by the microprocessor, that initiates the generation of the input pulses, calculates the time interval to the fault (column 8, lines 14-21), and also connects to a modem to report monitoring information (column 6, lines 40-45).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett to include a method for removing the unwanted near-end echo and a method for measuring the location of the fault in the communication line, as

taught by Westrom, since Liggett teaches that the near-end echo pulse is undesired and not used in measurements and Westrom provides a corresponding method to insure that the accuracy of the measurement is maintained by removing the unwanted pulse (i.e. the calculations will be based on full reflected pulses at the occurrence of a fault rather than the first extraneous pulse) and, as suggested by Westrom, the combination would have allowed quick repair or replacement of a transmission line fault by providing an exact location of the problem (column 1, lines 22-27).

Although the invention of Liggett and Westrom doesn't specifically disclose aligning the template signal and the correlated signal to determine a point of alignment, it is considered inherent that in order for the template signal to be subtracted from the correlated signal to correctly remove the near-end echo pulse, the signals must first be properly aligned.

With respect to claim 2, Liggett teaches correlating the generated sequence and the reflected sequence to generate a correlated signal for processing. Westrom teaches obtaining a template signal by sending actual pulses, consistent with actual implementation, to obtain the near-end signal created by the line interface.

Therefore the combination of the inventions of Liggett and Westrom would have provided a template signal as a correlated version of a reflection created by a line interface. Similarly, with respect to claim 27, since the invention of Westrom and Liggett teaches determining a time difference between the start of the signal, corresponding to the point where the line interface causes a near-end echo, and a

Art Unit: 2857

subsequent peak, the invention also teaches determining a time difference between the receipt of the near-end echo and a subsequent peak.

Further, with respect to claim 64 the invention of Liggett and Westrom teaches using a computer controller, and a corresponding memory of programs, to carry out the invention and perform processing functions. Therefore, although not specifically disclosed, it is considered inherent that this controller and memory would contain instructions in the form of processor readable code and program code logic to implement these processing and control functions.

11. Claims 7, 8, 10-12, 40, 41, 43, 61, 65-67, 69, and 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al. and further in view of U.S. Patent Application Publication No. 2002/0114383-A1 to Belge et al.

As noted above, the invention of Liggett and Westrom teaches all the features of the claimed invention except for specifying that the processing of the reflected sequence be used to determine the location of at least one impedance mismatch on the channel.

Belge teaches systems and methods for characterizing transmission lines using broadband signals in a multi-carrier DSL environment including performing time domain reflectometry by sending a signal over the DLS channel and analyzing the reflected echo to determine any impedance discontinuity (i.e. mismatch) caused by bridged taps, an open-end of the loop, load coils, or the like (0073 and 0076).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett and Westrom to include specifying that the processing of the reflected sequence be used to determine the location of at least one impedance mismatch on the channel, as taught by Belge, since Belge teaches that the bridged taps detected by the invention of Liggett and Westrom is actually the detection of an impedance mismatch. It also would have been obvious to include the detection of an impedance mismatch caused by a load coil because the combination would have allowed for the invention to detect and process the location of a wider variety of faults occurring on a DSL line.

Further, with respect to claim 70, the invention of Liggett and Westrom teaches a computer, and associated programs/code, for generating a sequence signal, as well as initiating transmission of a sequence signal over a communication channel, receiving a reflection caused by the sequence signal, and correlating the reflection signal and the generated sequence to form a correlated signal. Based on this teaching it considered inherent that a modified generated sequence would undergo the same method and be included the modified result with the initial, unmodified result, because the modified sequence would be sent through the same devices, with the same functions, in continuation with the initial signal sent.

12. Claims 6, 30, and 63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al. and further in view of U.S. Patent No. 5,062,703 to Wong et al.

As noted above, the invention of Liggett and Westrom teaches all of the features of the claimed invention except for adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal.

Wong teaches a method and apparatus for measuring the length of, or distance to discontinuities in, an optical transmission medium using optical time domain reflectometry by generating a pulse and transmitting the pulse through the optical line until a discontinuity is encountered wherein a portion of the pulse is reflected back to the measurement system (column 1, lines 37-51). Wong also teaches that by combining the reflected signal with an amplitude ripple generated due to the rotation of the incident and reflected optical signals (column 9, lines 21-50) the result can then be used to mathematically remove undesirable reflection (i.e. artifacts) from the desired response by gating components of the ripple pattern generated as the result of the rotation (column 11, lines 1-6).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett and Westrom to include adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal, as taught by Wong, because, as suggested by Wong, the combination would have provided a method for removing undesired artifacts and computing the propagation delay, as well as provided a method for determining multiple events attributable to different discontinuities in the channel (column 2, lines 46-54 and column 3, lines 3-12).

13. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in

view of Westrom et al. and Belge and further in view of U.S. Patent No. 4,963,020 to Luthra et al.

As noted above, Liggett in combination with Westrom and Belge teaches all the features of the claimed invention except for determining the location of a line anomaly by processing coefficients of a prediction filter.

Luthra teaches a method for detecting splices in an optical fiber using a time domain reflectometer that transmits a light pulse into an optical fiber and receives a reflected signal, which is stored in a memory, (column 2, lines 8-15) and also passed to a linear prediction filter (column 2, lines 29-38) (i.e. a finite impulse response filter) (column 2, lines 55-57), that has weights, corresponding to its coefficients (column 3, lines 50-54), which are used for determining a future signal to predict the splice (i.e. line anomaly) (column 2, line 67 to column 3, line 10). Luthra also teaches that the correlation filter be used to detect a splice by comparing the output of the correlation filter with a threshold (column 5, lines 19-26).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Westrom, and Belge to include determining the location of a line anomaly by processing coefficients of a prediction filter, as taught by Luthra, because, as suggested by Luthra, the combination would have removed decaying exponential portions of the reflected signal to provide only the desired information pertaining to line anomalies (column 2, lines 29-38).

14. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett

in view of Westrom et al. and Belge and further in view of Wong et al.

As noted above, Liggett in combination with Westrom and Belge teaches all of the features of the claimed invention except for adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal.

Wong teaches a method and apparatus for measuring the length of, or distance to discontinuities in, an optical transmission medium using optical time domain reflectometry by generating a pulse and transmitting the pulse through the optical line until a discontinuity is encountered wherein a portion of the pulse is reflected back to the measurement system (column 1, lines 37-51). Wong also teaches that by combining the reflected signal with an amplitude ripple generated due to the rotation of the incident and reflected optical signals (column 9, lines 21-50) the result can then be used to mathematically remove undesirable reflection (i.e. artifacts) from the desired response by gating components of the ripple pattern generated as the result of the rotation (column 11, lines 1-6).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Westrom, and Belge to include adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal, as taught by Wong, because, as suggested by Wong, the combination would have provided a method for removing undesired artifacts and computing the propagation delay, as well as provided a method for determining multiple events attributable to different discontinuities in the channel (column 2, lines 46-54 and column 3, lines 3-12).

15. Claims 21, 22, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al. and Belge and further in view of U.S. Patent No. 4,597,183 to Broding.

As noted above, Liggett in combination with Westrom and Belge teaches many of the features of the claimed invention including calculating the distance to an impedance mismatch using a time interval and propagation rate, but does not teach multiplying a time interval from the start of reflection to the occurrence of a signal component, indicating a fault, by one-half the rate of propagation of the reflection through the communication channel to determine the distance between one end of the communication channel and the impedance mismatch.

Broding teaches a method and apparatus for measuring a length of a cable using time domain reflectometry by transmitting a pulse sequence, in the form of an autocorrelation function (i.e. has good autocorrelation properties), over the communication channel (column 10, lines 35-41) and, upon the detection of its reflection, calculating the length of the round trip of the signal through the cable by multiplying a time interval between the generation of the sequence and a signal component indicating the reflection by the velocity of propagation. Broding also teaches the equivalent method for determining only the length of the cable during the initial trip by multiplying a time interval between the generation of the sequence and the signal component indicating reflection, or equivalently the time interval

between the signal component indicating reflection and the initial generation of the sequence, by one-half and the velocity of propagation (column 2, lines 48-61).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Westrom, and Belge to include multiplying a time interval from the start of reflection to the occurrence of a signal component, indicating a fault, by one-half the rate of propagation of the reflection through the communication channel to determine the distance between one end of the communication channel and the impedance mismatch, as taught by Broding, because Broding suggests an equivalent method for calculating the distance to a location down a cable using a method that will determine the exact distance to the point of interest, which can then be used for immediate analysis, rather than determining the round trip distance to and from the point of interest (column 2, lines 48-61).

16. Claims 23, 42, and 44 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al., Belge, and Broding, and further in view of U.S. Patent No. 5,523,758 to Harmuth.

As noted above, Liggett in combination with Westrom, Belge, and Broding teaches many of the features of the claimed invention including generating a maximum length sequence with a plurality of taps, but does not specify that the cross-correlation be performed using a sliding tapped delay line or that the sequence generator or correlator comprise a tapped delay line.

Harmuth teaches a method for receiving and processing reflected radar signals (column 1, lines 6-10) using cross-correlation performed by a sliding correlator over discrete taps of a circuit-delayed line (column 3, lines 40-58). Harmuth also teaches that the input signal arriving is fed into a tapped analog delay circuit to produce a tapped delay line (column 3, lines 30-35).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Westrom, Belge, and Broding to include specifying that the cross-correlation be performed using a sliding tapped delay line and that the sequence generator and correlator comprise a tapped delay line, as taught by Harmuth, because, as suggested by Harmuth, using a tapped delay line would have yielded a better approximation of the cross-correlation (column 3, lines 49-52) and, by using a sliding correlator, allowed the processing of a wider variety of pulses received by including very short pulses (column 1, lines 36-43).

Although Harmuth doesn't specifically disclose that the sequence generator comprises a tapped delay line, since Liggett discloses taps in the sequence generated and Harmuth teaches that the input line be a tapped delay line to provide more accurate cross-correlation, it would have been obvious to one having ordinary skill in the art to include these aspects in the sequence generator conform with the line connecting the remaining components.

17. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al., Belge, and Broding and further in view of Wong et al.

As noted above, Liggett in combination with Westrom, Belge, and Broding teaches all of the features of the claimed invention except for adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal.

Wong teaches a method and apparatus for measuring the length of, or distance to discontinuities in, an optical transmission medium using optical time domain reflectometry by generating a pulse and transmitting the pulse through the optical line until a discontinuity is encountered wherein a portion of the pulse is reflected back to the measurement system (column 1, lines 37-51). Wong also teaches that by combining the reflected signal with an amplitude ripple generated due to the rotation of the incident and reflected optical signals (column 9, lines 21-50) the result can then be used to mathematically remove undesirable reflection (i.e. artifacts) from the desired response by gating components of the ripple pattern generated as the result of the rotation (column 11, lines 1-6).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Westrom, Belge, and Broding to include adding a rotated reflection signal to the correlated signal to reduce or remove artifacts on the correlated signal, as taught by Wong, because, as suggested by Wong, the combination would have provided a method for removing undesired artifacts and computing the propagation delay, as well as provided a method for determining multiple events attributable to different discontinuities in the channel (column 2, lines 46-54 and column 3, lines 3-12).

18. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al. and further in view of U.S. Patent No. 4,041,381 to Hwa.

As noted above, the invention of Liggett and Westrom teaches all the features of the claimed invention except for specifying that the method be performed by an integrated circuit.

Hwa teaches methods and equipment for testing reflection points of transmission lines by transmitting a digital word from a maximal length sequence generator (column 2, lines 1-5) over a cable communication channel and receiving a reflection signal to indicate the occurrence of an impedance mismatch (column 1, lines 6-12). Hwa also teaches implementing the method using circuitry located on an integrated circuit (column 6, lines 40-49).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett and Westrom to include specifying that the method be performed by an integrated circuit, as taught by Hwa, because as suggested by Hwa the combination would have provided a device that could be manufactured cheaply and compactly so as to be used in a plurality of digital equipment (column 6, lines 40-49).

19. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al. and further in view of Broding.

As noted above, the invention of Liggett and Westrom teaches all the features of the claimed invention except for specifying that the test signal have good autocorrelation properties.

Broding teaches a method and apparatus for measuring a length of a cable using time domain reflectometry by transmitting a pulse sequence, in the form of an autocorrelation function (i.e. has good autocorrelation properties), over the communication channel (column 10, lines 35-41) and, upon the detection of its reflection, calculating the length of the round trip of the signal through the cable by multiplying a time interval between the generation of the sequence and a signal component indicating the reflection by the velocity of propagation. Broding also teaches the equivalent method for determining only the length of the cable during the initial trip by multiplying a time interval between the generation of the sequence and the signal component indicating reflection, or equivalently the time interval between the signal component indicating reflection and the initial generation of the sequence, by one-half and the velocity of propagation (column 2, lines 48-61).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett and Westrom to include specifying that the test signal have good autocorrelation properties, as taught by Broding, because, as suggested by Broding, the combination would have allowed lower frequencies to be used in the generation signal and therefore provided less cable attenuation (column 10, lines 35-41).

20. Claim 47 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett

Art Unit: 2857

in view of Westrom et al. and further in view of U.S. Patent No. 6,417,672 to Chong.

As noted above, the invention of Liggett and Westrom teaches all the features of the claimed invention except for specifying that the peak voltage of the sequence signal be less than 18 volts.

Chong teaches a method for detecting a bridge tap using frequency domain analysis through time-domain reflectometry to determine an impedance mismatch (column 4, lines 11-20) wherein a test set provides an input signal having a voltage of 20 volts peak-to-peak (i.e. a peak voltage of 10 volts) (column 11, lines 1-14).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett and Westrom to include specifying that the peak voltage of the sequence signal be less than 18 volts, as taught by Chong, because the invention of Liggett and Westrom teaches using a relatively low voltage to reduce the probability of cross-talk and, while Liggett and Westrom are silent on this voltage, Chong provides a voltage that would meet this requirement. It also would have been obvious to one having ordinary skill in the art to apply any voltage that is small enough to meet this cross-talk elimination since the applicant fails to provide criticality to the selection of 18 volts.

21. Claims 50, 51, and 53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al. and further in view of U.S. Patent No. 5,144,250 to Little.

As noted above, the invention of Liggett and Westrom teaches many of the features of the claimed invention including obtaining a time between the start of the correlation signal and a subsequent peak caused by the echo from a line anomaly but does not teach a corresponding device for measuring this time, specifically a timer that comprises a counter configured to count the samples between the start of the signal and a subsequent peak.

Little teaches a power amplifier time domain reflectometer, and corresponding method, comprising generating a modulated RF signal (column 2, lines 35-36), which is conducted on an output line to a plurality of system components which are to be tested for an impedance failure, and a bi-directional coupler that detects the waveform of the output RF signal and the waveform of the reflect RF signal caused by an impedance fault (column 1, lines 55-60). Little also teaches that the beginning of the output signal waveform is used to trigger a timing device which continues timing until the beginning of the reflected signal waveform is detected (column 1, line 60 to column 4) wherein the timing device comprises a counter that counts sample pulses between the start of the signal and a subsequent peak caused by the echo from the impedance failure (column 2, line 52 to column 2, line 12).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett and Westrom to include a timer that comprises a counter configured to count the samples between the start of the signal and a subsequent peak, as taught by Little, because the combination would have provided a timing device needed in the invention of Liggett and Westrom and, as suggested by Little,

Art Unit: 2857

provided a simplified method for performing time domain reflectometry in the Gigahertz frequency range (column 1, lines 45-47).

22. Claims 52 and 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al., Little, and Belge and further in view of U.S. Patent No. 6,122,652 to Jin et al.

As noted above, Liggett in combination with Westrom, Little, and Belge teaches many the features of the claimed invention including correlating a generated signal with a reflected signal and determining the position of detected peaks of the reflected waveform using a pulse detecting counter, but does not teach specifying that the correlation processing comprises a compare routine and a counter or that the peak detector comprises a comparator and a register for storing a current peak value.

Jin teaches a method for detecting a tone or any other periodical signal in a telephone system (column 1, lines 5-6) by segmenting the data signal into fixed length data samples, counting, with a counter, the data samples to prepare a data window therefrom, a peak value detector to monitor the data samples and to detect a sample having a peak value with the data window (column 2, lines 22-29), and a correlation unit (column 2, lines 48-49) wherein the peak detector comprises a comparator and memory (i.e. register) holding a current peak value (column 6, lines 29-33 and 39-46) and the correlation unit functions using a comparator and a counter (column 8, lines 18-34).

It would have been obvious to one having ordinary skill in the art to modify the invention of Liggett, Westrom, Little, and Belge to include specifying correlation processing comprises a compare routine and a counter and that the peak detector comprises a comparator and a register for storing a current peak value, as taught by Jin because, as suggested by Jin, the combination would have insured that any calculations made using a received peak voltage would be made with respect to the correct value by resetting the detector with the current value after a predetermined count (column 4, lines 63-65 and column 6, lines 46-47) and allow for the determination of whether the correlated value lies within a desired range (column 9, lines 30-39), as would be needed to discriminate between the correlated result of the received pulses, correlated with the generated sequence, and the correlated result of any extraneous noise pulses, correlated with the generated sequence, in the invention of Liggett, Westrom, and Belge.

23. Claim 54 is rejected under 35 U.S.C. 103(a) as being unpatentable over Liggett in view of Westrom et al. and Little and further in view of U.S. Patent No. 6,292,539 to Eichen et al.

As noted above, Liggett in combination with Westrom and Little teaches all the features of the claimed invention except for specifying that the sequence signal does not generate disruptive cross-talk in adjacent pairs in a binder that also contains the twisted pair conductor.

Art Unit: 2857

Eichen teaches a method and apparatus for digital subscriber loop qualification including a digital subscriber loop with a structure including bridge taps, load coils, and a binder group (i.e. a group of twisted pairs bundled together) (column 2, lines 3-9).

Since the invention of Liggett, Westrom, and Little teaches minimizing the voltage of the sequence signal to lower the possibility of cross-talk occurring across various twisted pairs (Liggett, column 5, lines 9-12) and Eichen teaches that a group of twisted pairs bundled together makes up a binder group, it would have been obvious to one having ordinary skill in the art to modify the invention of Liggett and Westrom to include lowering the voltage of the sequence signal to further reduce the possibility of cross-talk between adjacent twisted pairs in a binder because the combination would have prevented unwanted interference in a plurality of DSL environments.

Conclusion

24. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

U.S. Patent No. 5,514,965 to Westwood teaches a method and apparatus for testing a communicating line using time domain reflectometry.

25. Any inquiry concerning this communication or earlier communications from the

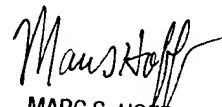
Art Unit: 2857

examiner should be directed to Jeffrey R. West whose telephone number is (703)308-1309. The examiner can normally be reached on Monday through Friday, 8:00-4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Marc S. Hoff can be reached on (703)308-1677. The fax phone numbers for the organization where this application or proceeding is assigned are (703)308-7382 for regular communications and (703)308-7382 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703)308-0956.

jrw
October 1, 2002


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